

CLAIMS:

1. A thermal interface composition comprising a blend of a polymer matrix and a filler possessing particles having a maximum particle diameter less than about 25 microns.
2. A thermal interface composition as in claim 1, wherein the polymer matrix comprises a curable polymeric composition.
3. A thermal interface composition as in claim 2, wherein the curable polymeric composition is selected from the group consisting of polydimethylsiloxane resins, epoxy resins, acrylate resins, organopolysiloxane resins, polyimide resins, polyimide resins, fluorocarbon resins, benzocyclobutene resins, and fluorinated polyallyl ethers, polyamide resins, polyimidoamide resins, cyanate ester resins, phenol resol resins, aromatic polyester resins, polyphenylene ether (PPE) resins, bismaleimide triazine resins, fluororesins, combinations thereof, and any other polymeric systems known to those skilled in the art.
4. A thermal interface composition as in claim 2, wherein the curable polymeric composition comprises an organopolysiloxane having an average of at least two silicon-bonded alkenyl groups per molecule, an organohydrogenpolysiloxane containing at least two silicone-bonded hydrogen atoms per molecule and a suitable hydrosilylation catalyst.
5. A thermal interface composition as in claim 1 wherein the filler is selected from the group consisting of fumed silica, fused silica, finely divided quartz powder, amorphous silicas, carbon black, graphite, diamond, silicone carbide, aluminum hydrates, aluminum oxides, zinc oxides, aluminum nitrides, boron nitrides, other metal nitrides, other metal oxides, silver, copper, aluminum, other metals, and combinations thereof.
6. A thermal interface composition as in claim 1 further comprising an adhesion promoter.

7. A thermal interface composition as in claim 6 wherein the adhesion promoter is selected from the group consisting of alkoxysilanes, aryloxysilanes, silanols, oligosiloxanes containing an alkoxy silyl functional group, oligosiloxanes containing an aryloxysilyl functional group, oligosiloxanes containing a hydroxyl functional group, polysiloxanes containing an alkoxy silyl functional group, polysiloxanes containing an aryloxysilyl functional group, polysiloxanes containing a hydroxyl functional group, cyclosiloxanes containing an alkoxy silyl functional group, cyclosiloxanes containing an aryloxysilyl functional group, cyclosiloxanes containing a hydroxyl functional group, titanates, trialkoxy aluminum, tetraalkoxysilanes, isocyanurates, and mixtures thereof.

8. A thermal interface composition as in claim 1 further comprising a catalyst inhibitor.

9. A thermal interface composition as in claim 8 wherein the catalyst inhibitor is selected from the group consisting of phosphines, phosphites, sulfur compounds, amines, isocyanurates, alkynyl alcohols, maleate esters, fumarate esters, and mixtures thereof.

10. A thermal interface composition as in claim 1 possessing an in-situ thermal resistance ranging from about 0.01 to about 80 mm²-C/W.

11. A thermal interface composition comprising a blend of a curable polymer matrix comprising an organopolysiloxane having an average of at least two silicon-bonded alkenyl groups per molecule and an organohydrogenpolysiloxane containing at least two silicone-bonded hydrogen atoms per molecule, a suitable hydrosilylation catalyst and an alumina filler possessing particles having a maximum particle diameter less than 25 microns.

12. A thermal interface composition as in claim 11 further comprising an adhesion promoter.

13. A thermal interface composition as in claim 12 wherein the adhesion promoter is selected from the group consisting of alkoxysilanes, aryloxysilanes,

silanols, oligosiloxanes containing an alkoxy silyl functional group, oligosiloxanes containing an aryloxysilyl functional group, oligosiloxanes containing a hydroxyl functional group, polysiloxanes containing an alkoxy silyl functional group, polysiloxanes containing an aryloxysilyl functional group, polysiloxanes containing a hydroxyl functional group, cyclosiloxanes containing an alkoxy silyl functional group, cyclosiloxanes containing an aryloxysilyl functional group, cyclosiloxanes containing a hydroxyl functional group, titanates, trialkoxy aluminum, tetraalkoxysilanes, isocyanurates, and mixtures thereof.

14. A thermal interface composition as in claim 11 further comprising a catalyst inhibitor.

15. A thermal interface composition as in claim 14 wherein the catalyst inhibitor is selected from the group consisting of phosphines, phosphites, sulfur compounds, amines, isocyanurates, alkynyl alcohols, maleate esters, fumarate esters, and mixtures thereof.

16. A thermal interface composition as in claim 11 wherein the molar ratio of Si-H to alkenyl ranges from about 0.5 to about 5.0.

17. A thermal interface composition as in claim 11 wherein the molar ratio of Si-H to alkenyl ranges from about 0.8 to about 2.0.

18. A thermal interface composition as in claim 11 possessing an in-situ thermal resistance ranging from about 0.01 to about 80 mm²-C/W.

19. A method of increasing heat transfer comprising:

positioning a heat producing component in contact with a thermal interface composition comprising a blend of a polymer matrix and a filler possessing particles having a maximum particle diameter less than about 25 microns; and

positioning a heat dissipating unit in contact with the thermal interface composition.

20. A method as in claim 19 wherein the step of positioning heat dissipating unit in contact with a thermal interface composition comprises positioning a heat dissipating unit selected from the group consisting of heat spreaders, heat sinks, lids, heat pipes, and other devices known to those skilled in the art.

21. A method as in claim 19 wherein the step of positioning heat producing component in contact with a thermal interface composition comprises positioning a heat producing component in contact with a blend of a curable polymer matrix and an alumina filler possessing particles having a maximum diameter of less than 25 microns.

22. A method as in claim 19 wherein the step of positioning heat producing component in contact with a thermal interface composition comprises positioning a heat producing component in contact with a blend of an organopolysiloxane having an average of at least two silicon-bonded alkenyl groups per molecule, an organohydrogenpolysiloxane containing at least two silicone-bonded hydrogen atoms per molecule, and an alumina filler possessing particles having a maximum diameter less than 25 microns.

23. A thermal interface composition as in claim 22 wherein the molar ratio of Si-H to alkenyl ranges from about 0.5 to about 5.0.

24. A thermal interface composition as in claim 22 wherein the molar ratio of Si-H to alkenyl ranges from about 0.8 to about 2.0.

25. A method as in claim 19 wherein the steps of positioning heat dissipating unit in contact with the thermal interface composition further comprises controlling a bond line thickness of the thermal interface composition by an additional step selected from the group consisting of applying pressure, adjusting viscosity of the thermal interface composition, and subjecting the filler to ball-milling.

26. A method as in claim 19 further comprising the step of curing the thermal interface composition.

27. A method as in claim 26 wherein the step of curing the thermal interface composition comprises adding a catalyst.

28. A method as in claim 27 wherein the step of curing the thermal interface composition comprises adding a platinum catalyst.

29. A method as in claim 27 wherein the step of curing further comprises adding a catalyst inhibitor selected from the group consisting of phosphines, phosphites, sulfur compounds, amines, isocyanurates, alkynyl alcohols, maleate esters, fumarate esters, and mixtures thereof.

30. A method as in claim 19 wherein the step of positioning heat producing component in contact with a thermal interface composition comprises adding to the thermal interface composition an adhesion promoter selected from the group consisting of alkoxysilanes, aryloxysilanes, silanols, oligosiloxanes containing an alkoxy silyl functional group, oligosiloxanes containing an aryloxysilyl functional group, oligosiloxanes containing a hydroxyl functional group, polysiloxanes containing an alkoxy silyl functional group, polysiloxanes containing an aryloxysilyl functional group, polysiloxanes containing a hydroxyl functional group, cyclosiloxanes containing an alkoxy silyl functional group, cyclosiloxanes containing an aryloxysilyl functional group, cyclosiloxanes containing a hydroxyl functional group, titanates, trialkoxy aluminum, tetraalkoxysilanes, isocyanurates, and mixtures thereof.

31. A method as in claim 19 wherein the step of positioning heat producing component in contact with a thermal interface composition comprises applying pressure to the thermal interface composition so that the thermal interface composition possesses a bond line thickness of from about 0.5 mil to about 5 mil.

32. A method as in claim 19 wherein the step of positioning heat producing component in contact with a thermal interface composition produces a thermal interface composition possessing an in-situ thermal resistance ranging from about 0.01 to about 80 mm²-C/W.

33. A method as in claim 19 wherein the step of positioning heat producing component in contact with a thermal interface composition further comprises positioning a thermal interface composition selected from the group consisting of pre-formed sheets, films, greases and phase change materials in contact with the heat producing component.

34. An electronic component comprising:

a heat producing component;

a heat dissipating unit; and

a thermal interface composition interposed between the heat producing component and the heat dissipating unit, the thermal interface composition comprising a blend of a polymer matrix and a filler possessing particles having a maximum particle diameter less than about 25 microns.

35. An electronic component as in claim 34, wherein the heat producing component is a semiconductor chip.

36. An electronic component as in claim 34, wherein the polymer matrix comprises a curable polymer.

37. An electronic component as in claim 34, wherein the polymer matrix is selected from the group consisting of polydimethylsiloxane resins, epoxy resins, acrylate resins, organopolysiloxane resins, polyimide resins, fluorocarbon resins, benzocyclobutene resins, fluorinated polyallyl ethers, polyamide resins, acrylic resins, polyimidoamide resins, phenol resol resins, aromatic polyester resins, polyphenylene ether (PPE) resins, bismaleimide triazine resins, fluororesins, combinations thereof and any other polymeric systems known to those skilled in the art.

38. An electronic component as in claim 34, wherein the curable polymeric composition comprises an organopolysiloxane having an average of at least two silicon-bonded alkenyl groups per molecule, an organohydrogenpolysiloxane

containing at least two silicone-bonded hydrogen atoms per molecule and a suitable catalyst.

39. An electronic component as in claim 34, wherein the filler is selected from the group consisting of fumed silica, fused silica, finely divided quartz powder, amorphous silicas, carbon black, graphite, diamond, silicone carbide, aluminum hydrates, aluminum oxides, zinc oxides, aluminum nitrides, boron nitrides, other metal nitrides, other metal oxides, silver, copper, aluminum, other metals and combinations thereof.

40. An electronic component as in claim 34, wherein the curable polymeric composition comprises a blend of an organopolysiloxane having an average of at least two silicon-bonded alkenyl groups per molecule and an organohydrogenpolysiloxane containing at least two silicone-bonded hydrogen atoms per molecule and the filler comprises alumina.

41. An electronic component as in claim 34 further comprising an adhesion promoter.

42. An electronic component as in claim 41 wherein the adhesion promoter is selected from the group consisting of alkoxysilanes, aryloxysilanes, silanols, oligosiloxanes containing an alkoxy silyl functional group, oligosiloxanes containing an aryloxysilyl functional group, oligosiloxanes containing a hydroxyl functional group, polysiloxanes containing an alkoxy silyl functional group, polysiloxanes containing an aryloxysilyl functional group, polysiloxanes containing a hydroxyl functional group, cyclosiloxanes containing an alkoxy silyl functional group, cyclosiloxanes containing an aryloxysilyl functional group, cyclosiloxanes containing a hydroxyl functional group, titanates, trialkoxy aluminum, tetraalkoxysilanes, isocyanurates, and mixtures thereof.

43. An electronic component as in claim 34 further comprising a catalyst inhibitor.

44. An electronic component as in claim 43 wherein the catalyst inhibitor is selected from the group consisting of phosphines, phosphites, sulfur compounds, amines, isocyanurates, alkynyl alcohols, maleate esters, fumarate esters, and mixtures thereof.

45. An electronic component as in claim 34, wherein the thermal interface composition possesses a bond line thickness of from about 0.5 mil to about 5 mil.

46. An electronic component as in claim 34, wherein the thermal interface composition possesses a thermal resistance ranging from about 0.01 to about 80 mm²-C/W.

47. An electronic component as in claim 34, wherein the thermal interface composition is a pre-applied material selected from the group consisting of pads, films, greases and phase change materials.